 STAT

CORNING GLASS WORKS
ELECTRO-OPTICS DEPARTMENT
RALEIGH, NORTH CAROLINA

IMPROVED SCREEN FOR REAR-PROJECTION VIEWERS

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ABSTRACT

Part of the current rear-view screen program is the fabrication of several optimized scattering-type screens of a size suitable for subjective testing. Screens approaching this description have been developed in a separate effort by a manufacturing division of Corning Glass Works. Since the size, gain, and resolution requirements for the two projects differ, some but not extensive, alteration of the process and equipment will be necessary in order to apply the process to our screens. This report describes production techniques, subjective evaluation of the benefits of antireflection coatings and a darkened substrate, and progress to date on fabrication of the desired 12-1/8" x 15-1/8" screens.

TECHNICAL REPORTS NOS. 34 AND 35

I. INTRODUCTION

Part of the current rear-view screen program is the fabrication of several optimized scattering-type screens of a size suitable for subjective testing. Screens approaching this description have been developed in a separate effort by a manufacturing division of Corning Glass Works. Since the size, gain, and resolution requirements for the two projects differ, some but not extensive, alteration of the process and equipment will be necessary in order to apply the process to our screens. This report describes our progress in this effort.

II. Production Techniques

The Electronic Products Division of Corning Glass Works has developed a technique for producing rear-view screens using ground glass in a plastic binder. This diffusing layer is applied to a glass substrate as a 3 mil thick coating which dries to a 1.5 mil coating. A number of difficulties were overcome in perfecting these techniques. First it was necessary to find a way to suitably wet the glass particles with the binder. Next, various methods of coating were tried. A dipping process appeared promising but was abandoned because of the difficulty of eradicating bubbles. A successful casting technique was then developed. This consisted of wiping the glass-plastic slurry across the substrate with a suitably designed casting knife which produced a uniformly thick coating. They have experimented extensively to determine the effect of particle size, glass-to-binder ratio, and film thickness on measurable screen parameters. These coatings have been applied to clear plate glass and to 50% absorbing plate glass. Antireflection coatings have been applied to the non-scattering surface, which then faces the observer in a test situation.

Four of these screens, with and without antireflection coatings and with and without the absorbing substrate, were subjectively compared. The following table describes these screens.

Screen	Antireflection Coating	Substrate Transmittance	Axial Gain	Particle Size
A	No	1	9	4 - 6 μ
B	Yes	1	9	4 - 6 μ
C	No	.5	20	12 - 15 μ
D	Yes	.5	20	12 - 15 μ

The axial gain of the scattering layers of screens C and D was increased to compensate for the 50% loss in efficiency incurred by the absorbing substrate. The antireflection coatings definitely reduced specular reflection to an acceptable value. The faint purple bloom which they produce could be removed, if objectionable, by cutting off the extreme violet and red ends of the ambient light spectrum. Also it could definitely be seen that the absorbing substrate was significantly reducing the diffusely reflected light and the trapped light. More extensive objective and subjective comparisons are planned.

III. Choice of Screen Parameter Values

The new set of test screens to be designed expressly for this project are to fit a 12-1/8" x 15-1/8" holder. Following the guidelines of the previous report P-19-32, we are aiming for a diffuse reflectance of 5%, a brightness variation of ± 25%, an axial gain of approximately 3, and a scattering layer efficiency of 40 - 60%. Various values of substrate darkening will be tried to get an optimum trade-off between efficiency and attenuation of all forms of extraneous light, i.e., diffusely reflected, trapped projector, and trapped ambient light. It may also be desirable to vary the axial gain for comparative purposes.

A 1.5 mil thick diffusing layer may provide sufficient resolution, or it may be necessary to use a thinner coating. This tightens the tolerances on substrate flatness and casting knife straightness.

IV. Progress to Date on Fabrication of 12-1/8" x 15-1/8" Screens.

Samples of absorbing plate glass have been procured and tested for transmittance and flatness. Selected samples appear to be flat to about ± 0.3 mil over a 20" span. This should be flat enough for the thicker coatings. If thinner coatings become necessary, the plates may have to be ground and polished flat. Quotations on antireflection coatings have been solicited. Because the process is being scaled up in size, a larger casting knife must be purchased or constructed. One source of supply has been found and the knife will be purchased if it meets our specifications and time schedule or contructed in our shop otherwise.